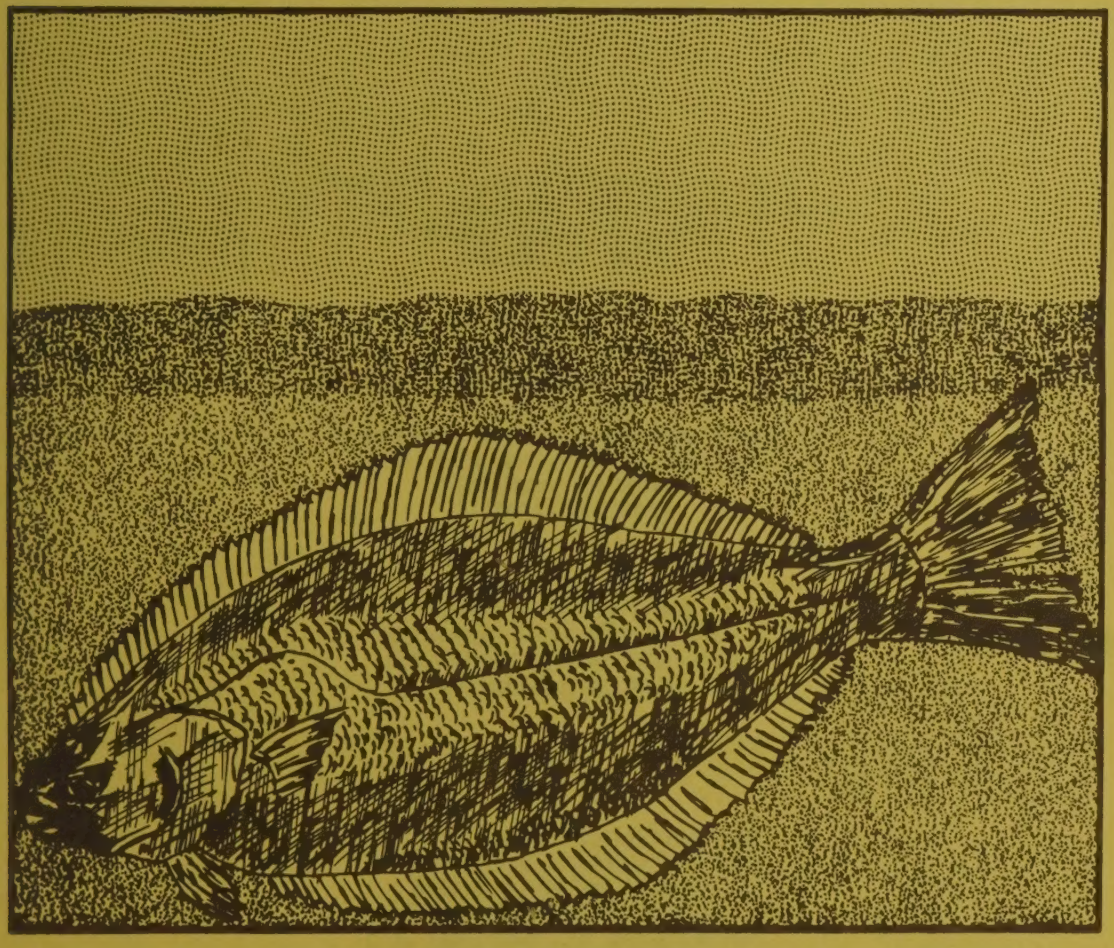
Biological Report 82(11.44)
April 1986

TR EL-82-4

Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (Pacific Southwest)

CALIFORNIA HALIBUT



Fish and Wildlife Service
U.S. Department of the Interior

Coastal Ecology Group
Waterways Experiment Station
U.S. Army Corps of Engineers

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Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (Pacific Southwest)

CALIFORNIA HALIBUT

by

Stephen T. Kucas and Thomas J. Hassler
California Cooperative Fishery Research Unit
Humboldt State University
Arcata, CA 95521

Project Officer
John Parsons
National Coastal Ecosystems Team
U.S. Fish and Wildlife Service
1010 Gause Boulevard
Slidell, LA 70458

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PREFACE

This species profile is one of a series on coastal aquatic organisms, principally fish, of sport, commercial, or ecological importance. The profiles are designed to provide coastal managers, engineers, and biologists with a brief comprehensive sketch of the biological characteristics and environmental requirements of the species and to describe how populations of the species may be expected to react to environmental changes caused by coastal development. Each profile has sections on taxonomy, life history, ecological role, environmental requirements, and economic importance, if applicable. A three-ring binder is used for this series so that new profiles can be added as they are prepared. This project is jointly planned and financed by the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service.

Suggestions or questions regarding this report should be directed to one of the following addresses.

Information Transfer Specialist
National Coastal Ecosystems Team
U.S. Fish and Wildlife Service
NASA-Slidell Computer Complex
1010 Gause Boulevard
Slidell, LA 70458

or

U.S. Army Engineer Waterways Experiment Station
Attention: WESER-C
Post Office Box 631
Vicksburg, MS 39180

CONVERSION TABLE

Metric to U.S. Customary

Multiply	By	To Obtain
millimeters (mm)	0.03937	inches
centimeters (cm)	0.3937	inches
meters (m)	3.281	feet
kilometers (km)	0.6214	miles
square meters (m^2)	10.76	square feet
square kilometers (km^2)	0.3861	square miles
hectares (ha)	2.471	acres
liters (l)	0.2642	gallons
cubic meters (m^3)	35.31	cubic feet
cubic meters	0.0008110	acre-feet
milligrams (mg)	0.00003527	ounces
grams (g)	0.03527	ounces
kilograms (kg)	2.205	pounds
metric tons (t)	2205.0	pounds
metric tons	1.102	short tons
kilocalories (kcal)	3.968	British thermal units
Celsius degrees	1.8(°C) + 32	Fahrenheit degrees

U.S. Customary to Metric

inches	25.40	millimeters
inches	2.54	centimeters
feet (ft)	0.3048	meters
fathoms	1.829	meters
miles (mi)	1.609	kilometers
nautical miles (nmi)	1.852	kilometers
square feet (ft^2)	0.0929	square meters
acres	0.4047	hectares
square miles (mi^2)	2.590	square kilometers
gallons (gal)	3.785	liters
cubic feet (ft^3)	0.02831	cubic meters
acre-feet	1233.0	cubic meters
ounces (oz)	28.35	grams
pounds (lb)	0.4536	kilograms
short tons (ton)	0.9072	metric tons
British thermal units (Btu)	0.2520	kilocalories
Fahrenheit degrees	0.5556(°F - 32)	Celsius degrees

CONTENTS

	Page
PREFACE	iii
CONVERSION TABLE	iv
ACKNOWLEDGMENTS	vi
NOMENCLATURE/TAXONOMY/RANGE	1
MORPHOLOGY/IDENTIFICATION AIDS	1
REASON FOR INCLUSION IN SERIES	1
LIFE HISTORY	3
Spawning	3
Larval Stage	3
Juveniles	3
Maturity and Life Span	3
GROWTH CHARACTERISTICS	3
COMMERCIAL AND SPORT FISHERIES	4
ECOLOGICAL ROLE	4
ENVIRONMENTAL REQUIREMENTS	5
Temperature	5
Depth	5
Substrate	5
Other Environmental Factors	5
LITERATURE CITED	7

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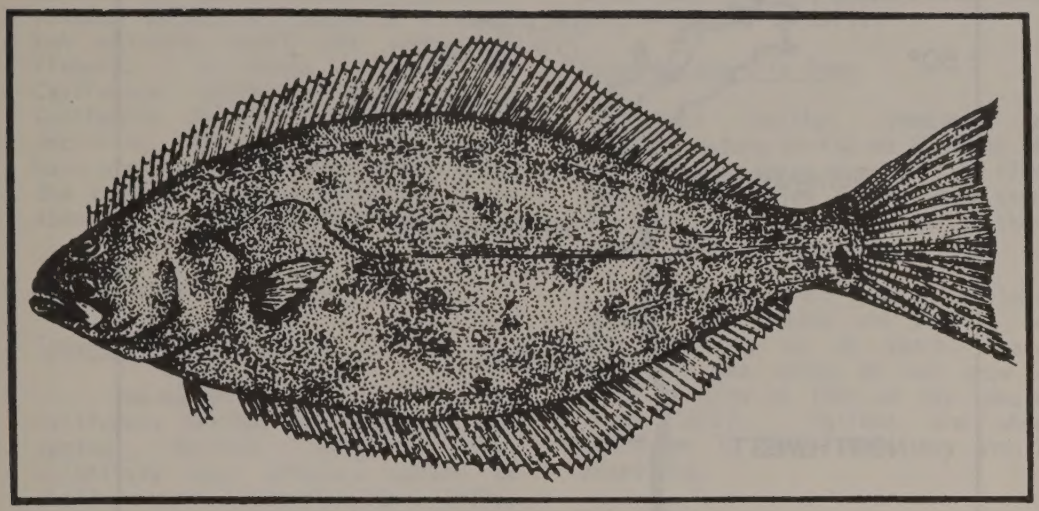

Figure 1. California halibut.

CALIFORNIA HALIBUT

NOMENCLATURE/TAXONOMY/RANGE

Scientific name ..... Paralichthys californicus (Ayres)
Preferred common name ..... California halibut (Figure 1)
Class ..... Osteichthyes
Order ..... Pleuronectiformes
Family ..... Bothidae

Geographic range: Gulf of California (isolated population), and from Magdalena Bay, California, to Quillayute River, Washington (Miller and Lea 1972; Figure 2). Most occur below San Francisco Bay (Haaker 1975).

MORPHOLOGY/IDENTIFICATION AIDS[1]

Fin rays -- dorsal 66-76, anal 49-59, pectoral 10-13; lateral line scales about 100; gill rakers 7-11 + 18-23; vertebrae 34-36; eyes sinistral or dextral. Body elliptical, slender; head small; mouth large, maxillary extending to or beyond rear edge of lower eye; teeth strong and sharp on both sides of head; eyes small; interorbital space wide, flat; lateral line with high arch over pectoral fin; scales small, smooth; caudal fin indented.

Color in life: eyed side grayish or greenish-brown, sometimes mottled with lighter and darker shades; small white spots; and blind side white to cream. Young fish with bluish-white spots (Bane and Bane 1971); partial pigmentation has been reported on the eyed side (Haaker and Lane 1973).

REASON FOR INCLUSION IN SERIES

The California halibut commonly lives in bays and estuaries along the

[1] Largely extracted from Miller and Lea (1972).

Figure 2. Coastal distribution of the California halibut.

central and southern California coast (Haaker 1975), and supports a small but valuable sport and commercial fishery. A sharp reduction in California halibut landings from California in the late 1920's and declining landings in recent years have prompted scientists to determine the cause. To date little is known about its biology and life history.

LIFE HISTORY

Spawning

The major spawning areas for the California halibut are unknown. In spring, halibut emigrate from relatively deep offshore waters to shallow coastal waters (Clark 1930a, 1930b) to spawn at depths of 5 to 18 m (Young 1960). California halibut spawn from February through July, peaking in May (Ginsberg 1952). The eggs are demersal. After spawning the adults return to water about 40 to 100 m deep (Ginsberg 1952).

Larval Stage

The larval and postlarval stages of the California halibut are pelagic for several months before the postlarvae settle to the bottom (Winzler and Kelly Consulting Engineers 1977). In southern California, the planktonic larval stages, about 10 mm standard length (SL), are pelagic and live in water 12 to 45 m deep and 1.9 to 5.4 km out from shore. Larger and older larvae live closer to shore, and most are suspected to live in embayments (Plummer et al. 1983).

Juveniles

Juveniles begin to settle and assume bottom dwelling habits in June (Frey 1971); they remain in shallow water and do not move extensively (Frey 1971; Haaker 1975). Juvenile halibut begin to emigrate to deeper water when they are about 200 mm total length (TL) (Frey 1971).

Maturity and Life Span

Most halibut females are sexually mature at 430 mm TL or at the end of their third year of life (Frey 1971). Most males mature when about 230 mm TL long or at the end of their second year of life.

Halibut are generally long-lived. Both males and females may live as long as 30 years, though generally the males do not grow as large or live as long as the females (Frey 1971). Halibut are about 1,080 mm TL long when they are 12 years old.

GROWTH CHARACTERISTICS

The age and rate of growth of halibut from California commercial landings were reported by Frey (1971). Table 1 summarizes this information.

The growth rate of female halibut in their first and second years of life (Haaker 1975) was slower

Table 1. Age and growth (mid-year lengths) of female halibut from California commercial landings (from Frey 1971).

Year	Mid-year length (mm TL)	Weight (kg)
1	178	0.057
2	318	0.340
3	439	0.907
4	553	1.758
5	648	2.835
7	813	5.783
9	940	9.072
12	1054	10.745

in Anaheim Bay, California, than that reported by Frey (1971) from California commercial landings. In their third year, growth of females from Anaheim Bay was greater than that reported from California landings. Data were not available for other age groups.

COMMERCIAL AND SPORT FISHERIES

The California halibut supports a small but lucrative sport and commercial fishery. The demand for the species is high, but its abundance and availability are relatively low.

Records of the commercial catches of California halibut from 1916 to 1947 were summarized by Holmberg (1949). Frey (1971) summarized the California landings data to 1969. Commercial landings data of California halibut from 1939 to 1984 are presented in Figure 3.

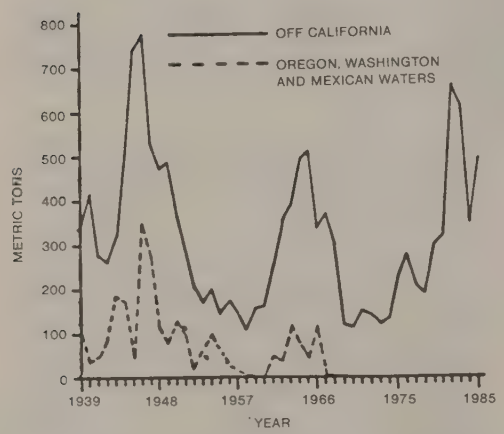

Figure 3. Commercial landings of California halibut from 1939 to 1984 (data from U.S. National Marine Fisheries Service 1942-1984 and California Department of Fish and Game preliminary monthly landings data 1978-1984).

The commercial catch of the California halibut for California, Washington, Oregon, and Mexican waters declined from 2,131 t in 1919 to 330 t in 1941 (Holmberg 1949). From 1941 to 1969 the average annual catch was 419 t. Large catches in 1946 and 1947, 1,134 t and 811 t respectively, may be attributed to reduced fishing during World War II, which allowed the halibut stocks to build up (Frey 1971). After 10 years (1947-1956) of unusually cold water along the California coast, the commercial catch increased from 161 t in 1959 to 578 t in 1964. The catch then declined to 117 t in 1970, the lowest catch on record.

From 1971 to 1983 the catch of California halibut averaged 271 t (range: 123 t to 563 t). The value of the commercial landings of California halibut in 1977 was estimated at $460,000 (U.S. National Marine Fisheries Service 1942-1984). More recent estimates have not been published.

ECOLOGICAL ROLE

The larvae and young juveniles of the California halibut are planktivorous, but as they grow to adulthood they become piscivorous (Haaker 1975; Plummer et al. 1983). Halibut 230 mm TL long or longer feed heavily on fish (primarily during daylight) and, to a lesser extent, on shrimp (Haaker 1975).

Juvenile and adult California halibut are especially adapted for catching and digesting fish because they are equipped with long heavily toothed gill rakers that aid in holding and swallowing, an intestine with a simple loop, and a brain with large optic lobes (Haaker 1975). This raptorial predator has sharp canine-like teeth and a large mouth.

Haaker (1975) found that the stomachs of halibut 12 to 510 mm long contained 65% fish, 34% crustaceans,

and 1% mollusks, though the diet of these fish changed as the fish grew. For example, halibut less than 55 mm long ate mostly small fish (gobies) and small crustaceans such as amphipods, copepods and mysids. Fish from 55 to 230 m ate larger crustaceans and fishes. Larger halibut ate larger prey (Plummer et al. 1983). The northern anchovy, Engraulis mordax, is probably the most important prey of the California halibut (Frey 1971).

ENVIRONMENTAL REQUIREMENTS

Temperature

Laboratory behavioral studies indicated that California halibut in age groups 0 and I are eurythermal, whereas individuals in age group II and older tended to be stenothermal (Innis 1980). Adult halibut placed in a water temperature gradient chamber preferred water temperatures between 15 ^{o}C and 23 ^{o}C (Innis 1980).

Depth

California halibut about 100 mm long (SL) were largely absent from nearshore coastal waters 6 to 30 m deep off northern San Diego County and occurred primarily in embayments (Plummer et al. 1983). Age I+ fish (15-25 cm SL) and II+ (30-45 cm SL) and older fish (Haaker 1975; Innis 1980) segregate by depth, with older juveniles and young adults occurring deeper than younger juveniles. Adults prefer deeper water (Haaker 1975; Innis 1980). The California halibut inhabits offshore waters as deep as 100 m (Miller and Lea 1972), but most are caught commercially on the bottom at water depths of 6 to 40 m (Ginsberg 1952).

Substrate

Adult California halibut occur over sandy bottoms from the surf zone to 100 m (Jones and Stokes, Inc. 1981).

Other Environmental Factors

Shallow bays and estuaries may be critical habitat for the survival and growth of larvae and young juveniles, and the shallow waters of the open coast almost surely serve as nursery grounds for California halibut (Plummer et al. 1983; Haaker 1975). Consequently, major alterations of bays and estuaries along the coast of California could be harmful to halibut habitat and reduce the abundance of halibut.

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Stephen T. Kucas and Thomas J. Hassler

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California Cooperative Fishery Research Unit
Humboldt State University
Arcata, CA 95521

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Fish and Wildlife Service
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16. Abstract (Limit: 200 words)

Species profiles are literature summaries of the taxonomy, morphology, distribution, life history, and environmental requirements of coastal aquatic species. They are prepared to assist in environmental impact assessment. The California halibut, Paralichthys californicus, usually lives nearshore at depths of 100 m or less. It spawns at depths of 5 to 18 m; spawning is from February to July and peaks in May. Some California halibut may live as long as 30 years. Annual commercial catches (1916-1984) for California ranged from 29 to 779 t. Juvenile halibut feed on zooplankton and small fish; adults are almost totally piscivorous. Adults preferred temperatures of 15 to 23 °C. Shallow bays and estuaries are probably important nursery grounds for the California halibut. Information about the environmental requirements of the California halibut is scarce.

17. Document Analysis a. Descriptors
Fishes
Growth
Feeding habits
Estuaries
Life Cycles
Fisheries
Depth

b. Identifiers/Open-Ended Terms
California halibut
Paralichthys californicus
Spawning

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Lloyd Five Hundred Building, Suite 1692
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Portland, Oregon 97232

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U.S. Fish and Wildlife Service
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Albuquerque, New Mexico 87103

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